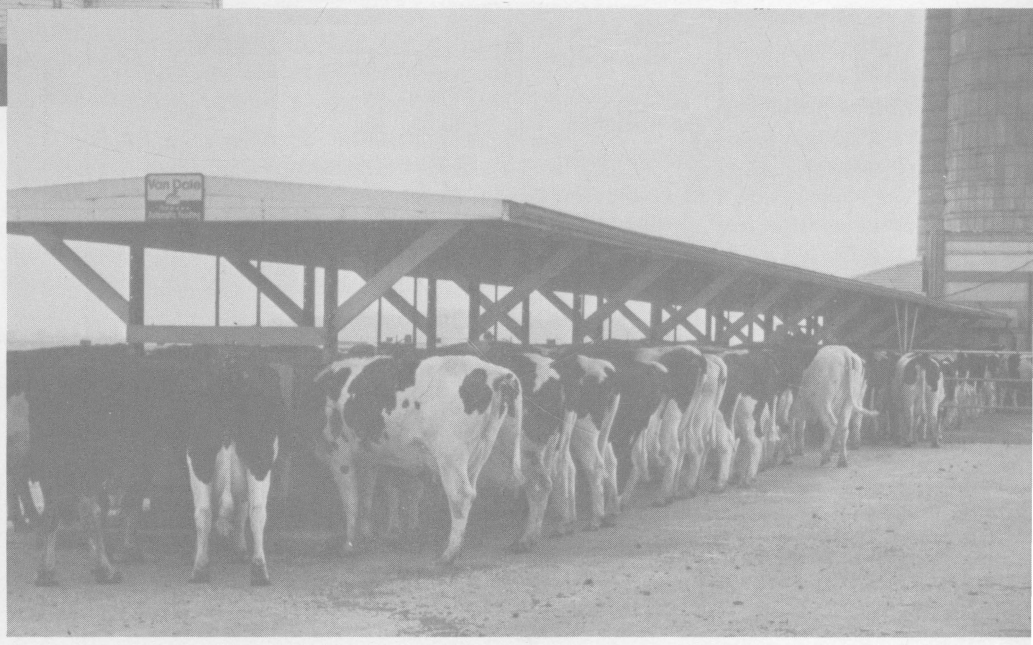
Bulletin 479

Forage Feeding Systems

for Dairy Cattle



COOPERATIVE EXTENSION SERVICE
THE OHIO STATE UNIVERSITY

COVER PHOTO—Along with a trend toward larger dairy herds is that of greater use of feeding stored forage in the form of corn silage and high dry matter grass silage, both of which can be fed automatically. These high-producing cows receive high-quality silage year round in the dry lot.

ACKNOWLEDGMENTS

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Forage Feeding Systems

for Dairy Cattle

Forage occupies a prominent position in the feeding of Ohio's dairy cows. The main purpose served by forages in the diet of dairy cattle is to provide energy (provides 60% or more of the net energy), protein, minerals, and vitamins. Good quality grasses and legumes are comparable in energy value; however, the legumes have a higher protein, Vitamin A, and calcium content.

A good forage program depends on soil fertility and on following certain recommended and tested practices. Ohio State University agronomists have found the following to be effective aids in increasing forage yields:

1. Using tested, approved, and recommended varieties.
2. Selecting a seeding mixture that is compatible with respect to soil type, date of maturity, and the use for which the forage is intended.
3. Correcting lime and soil fertility deficits based on soil tests and the crop or crops to be grown.
4. Seeding on time and applying recommended seeding practices.
5. Harvesting forage on or near the recommended dates for high quality and good yield.

Liming will permit taking full advantage of high-yielding legumes. Since high-yielding forage crops contain large amounts of nutrients, they are heavy users of phosphorous and potash. The effect of soil acidity on hay yield has been demonstrated by workers at the Ohio Agricultural Research and Development Center. Their findings show a yield of 2.6 tons of alfalfa-mixed hay from soil at pH 5.4, 2.9 tons at pH 5.8, 3.3 tons at pH 6.5, and 4.0 tons at pH 7.1. In studying the effect of phosphorus levels on alfalfa yield, the researchers found that yields ranged from 1.6 tons of hay per acre, when phosphorus levels were low, to a yield of 4.2 tons per acre when the phosphorus level was high.

Taking a good soil sample and having it analyzed can provide the key to fertilizer and lime needs. High-yielding forage crops are hearty eaters.

NUTRITIVE VALUE OF FORAGES

Whether a meadow crop is harvested as hay, silage or pasture, the date on which the crop is harvested has been found to have a major influence on intake and digestibility of the forage by ruminants. The dairy cow will consume greater quantities of early cut, highly digestible forages than those harvested late.

Since harvesting too early reduces yields and results in some loss of legume stands, and since late harvesting results in poor-quality forage the agronomists and dairy scientists have compromised in arriving at recommended dates for harvesting grasses and legumes to the extent that those recommended will not normally reduce stands but will still produce forages that are of good quality and highly digestible.

Recommended harvest dates for various forage mixtures grown in Ohio are listed in Table 1.

Table 1

Recommended Harvest Dates—
First Cutting Legume-Grass Mixtures

	CUTTING SCHEDULE		
Forage Mixtures	Southern Ohio	Central Ohio	Northern Ohio
Alfalfa-common Orchard Grass	May 15-20	May 18-23	May 23-28
Alfalfa-Bromegrass	May 20-25	May 23-28	May 28-June 5
Alfalfa-Timothy	May 20-25	May 23-28	May 28-June 5
Red Clover-Timothy	May 24-June 5	June 1-10	June 1-15
Birdsfoot Trefoil-Timothy	May 20-June 1	May 25-June 15	June 1-20

(From Ohio Extension Service Bulletin 413, Harvest Schedules)

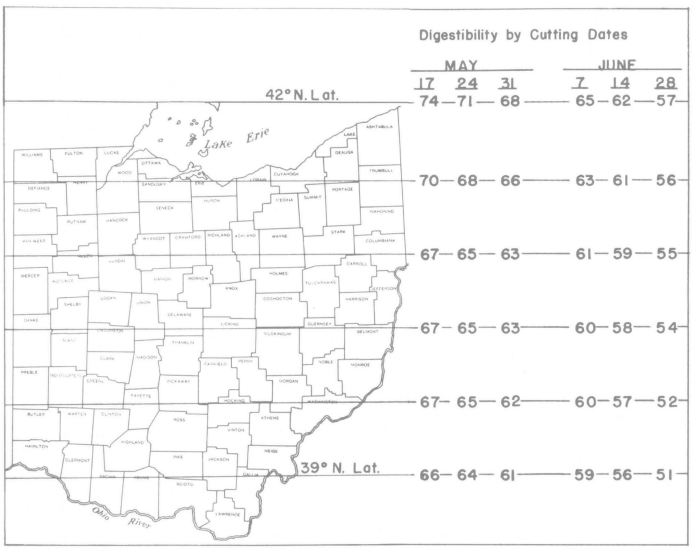
When harvesting according to the recommendations in Table 1, the farmer can reduce the risk of losing alfalfa stands by maintaining soil fertility and lime at high levels. Researchers have also noted that harvesting first year meadows after second or

third year meadows (within the recommended range of harvesting dates) will help reduce loss of alfalfa stands.

Dry matter yields will be lower than would be obtained from later harvests; however, yields of digestible dry matter per acre will generally equal or exceed those from later harvests.

Second and third cuttings (mowing or grazing) should be made after 35 to 40 days regrowth because the digestibility and acceptability of forage decreases rapidly after 40 days of regrowth.

According to dairy scientists at the Ohio Agricultural Research and Development Center, cutting dates are the best means presently available for an on-the-farm estimate of forage digestibility. In terms of per cent digestibility, Ohio workers have found that forages harvested when they contain 63 per cent or more digestible dry matter are considered to be excellent quality roughages. The dry matter digestibilities for various lines of latitude in Ohio are shown in Figure 1. Dry matter digestibility is a good estimate of the energy value of each forage and the more digestible the forage, the higher the rate of voluntary consumption. Reliable estimates of digestibility are useful in calculating the ration for dairy cows.



Percentage Digestibility at Various Latitudes in Ohio of Legume-grass Forage

Fig. 1—Lines of latitude at 40-mile intervals are shown with estimates of dry matter digestibilities for six cutting dates. Part of these data were interpolated, based on the results of experiments at the Ohio Agricultural Research and Development Center, Wooster; Cornell University, Ithaca, N.Y.; and the U.S.D.A., Beltsville, Maryland.

Workers at Cornell University have demonstrated that early harvested first cutting forage, even after it was rained on or deliberately weathered for as much as six days during an eight-day period, was still higher in dry matter digestibility (57%) than that harvested from the same source four weeks later (52%) with no weather damage. Ohio workers have observed similar results in their studies.

The final critical measure is the response of dairy cows to forages cut at different times from the same source. This is illustrated in Table 2 using Cornell University data (recommended harvest dates for New York for first cutting are later than those for Ohio because the state is located farther north).

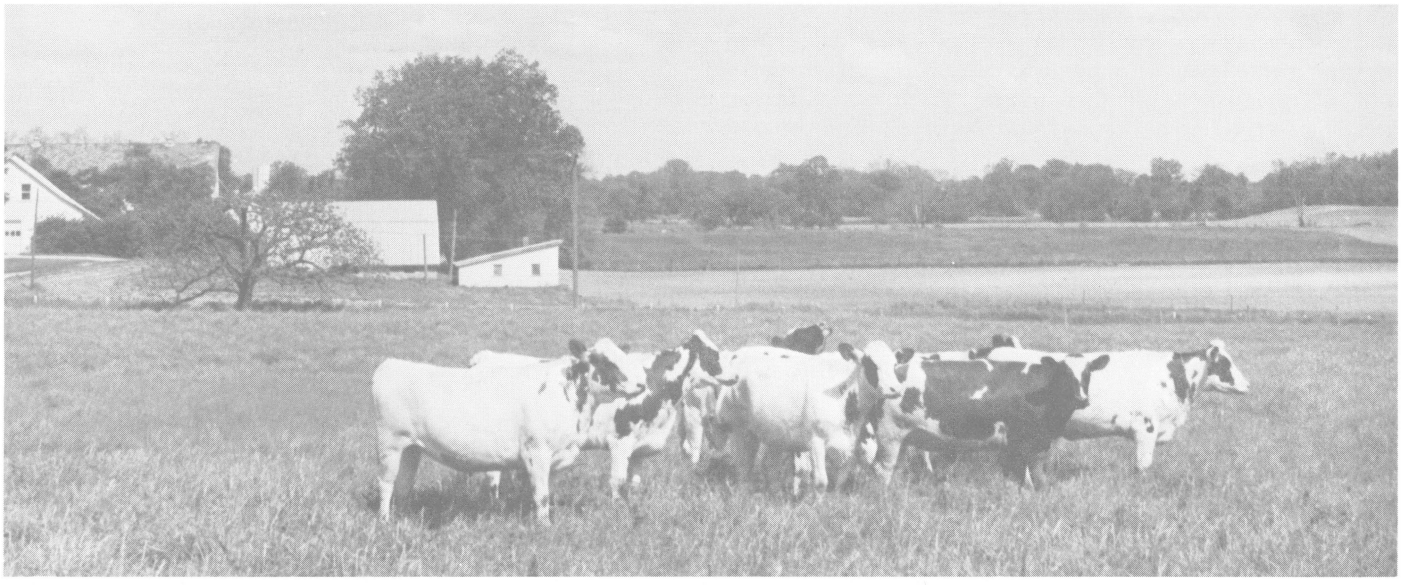
Table 2

Cutting Date	RESPONSE OF COWS 4% F.C.M. Per Day	Body wt. Change Per Day	Hay T.D.N.	Intake Per Day
June 11	42.7 lbs.	+0.4 lb.	66%	28.1 lbs.
July 9	30.9 lbs.	—0.1 lb.	51%	21.8 lbs.

(J. T. Reid—Cornell J.D.Sc., Vol. 42, p. 568)

Hay harvested on June 11 was nearly 30 per cent higher in T.D.N. (Total Digestible Nutrients) and was consumed at a rate of about 30 per cent greater than that of the hay harvested on July 9; nearly 40 per cent more milk was produced and one-half pound more body weight was gained per day by cows consuming early-cut hay than by those fed late-cut hay. This demonstrates that cutting dates have a profound effect upon forage quality.

This combination mower-crusher-windrower reduces labor, speeds drying time, and can help dairymen meet the need for early harvesting of forage.

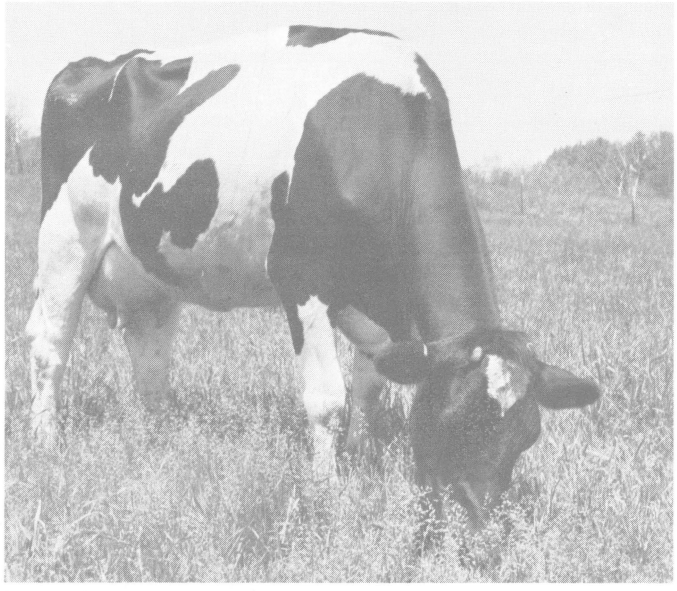


Yearling and bred heifers need little, if any, grain when the pasture is luxuriant such as that pictured in this orchardgrass-Ladino clover plot.

PASTURE FOR THE DAIRY HERD

Pasture is Good Feed

On many Ohio dairy farms the most economical source of nutrients for dairy cattle is forage utilized in the form of pasture. During the pasture season, an abundance of good pasture can provide a large share of the nutrient requirements for a dairy cow. Cows consuming up to 150 pounds of good pasture daily are provided with enough nutrients for body maintenance and the production of 30 to 35 pounds of 3.5 per cent milk. Ohio DHIA records show that, on the average, pasture provides about 15 per cent of the total digestible nutrients used by cows in DHIA herds.



Improved permanent pasture can provide a good source of early spring forage such as this cow is grazing.

PASTURE SYSTEMS DEFINED

1. **Continuous grazing**—turning the cows out to pasture and leaving them on the same pasture throughout the season.
2. **Rotation grazing**—dividing the pastures into two or more areas and rotating the milking cows from one pasture to another on a planned schedule.
3. **Daily rotational grazing**, or **strip grazing**—a system of pasture management in which the cows are pastured on a new strip of pasture each day or part of a day.
4. **Green feeding**—cutting pasture and hauling the green forage to the cows daily.
5. **Stored feeding**—forage crops on the farm are preserved as hay or silage and fed in dry lot.

There is general agreement among research workers that reasonably high levels of milk production can be maintained under any of the pasture systems. Good management of the pastures or areas harvested provides sufficient feed at all times to maintain body weight, milk production, animal health, and to utilize the crop without undue waste.

In many studies the difference in milk production per cow under various systems is small, but the land area required to provide the necessary forage is quite different, making differences in yields of milk per acre. Under the average farm setup, for the most part, low production is not due primarily to the grazing system used for summer feeding, but mainly to lack of feed in the system.

In recent years more and more dairymen have discovered that pasture land can often be just as productive as their good crop areas. Many have changed from conventional or continuous grazing to some more efficient method of harvesting forage. To avoid a summer slump in milk production, dairy-

men are providing supplemental feedings of hay and silage, providing better forage such as grass-legume mixtures, and by adopting improved methods of grazing and harvesting such as rotation grazing, strip grazing, green feeding, and stored feeding.

There is no "best" pasture system for all farms nor does any one system fit all forages on any one farm. There are a number of factors to consider in selecting a pasture system or systems best adapted to an individual farm.

Most dairy farmers have a choice of the crops they produce and the grazing, harvesting, and storage methods which they can use. These choices are influenced to some extent by the amount of cropland, whether the crops are complimentary or competitive, the intensity of the livestock program, the labor supply, and by the buildings, equipment, and capital that are available.

An evaluation of alternative systems as to how they are likely to affect investments, labor requirements, expenses, and net income could be helpful in choosing a system. A combination of different pasture systems may prove more desirable than a single system. On many dairy farms some flexibility is needed in the summer forage feeding program. This would permit year-to-year changes to offset weather conditions. Sometimes it may be desirable to graze pastures early, when the labor demand is heavy, and to use either stored feeding or green feeding (soilage) for the remainder of the pasture season. Many Ohio dairymen could probably increase net income more by improving the system or systems now in use on their farms than by shifting to a new one.

ROTATION GRAZING

On many farms where alfalfa-grass mixtures are being used for pasture, it is not convenient or practical to use these crops through a green chop or stored feeding program and, therefore, a rotation grazing system may seem desirable.

Workers at the O.A.R.D.C. compared rotational with continuous grazing in three consecutive grazing seasons. The cows grazed a mixture of ranger alfalfa, ladino clover, and Lincoln bromegrass. Cows grazed rotationally remained on a paddock for 4 to 10 days.

Paddocks not needed for grazing were harvested for grass silage or hay, and yields were measured. There was no harvest other than grazing on the continuously grazed pasture. The results of the experiment showed no difference in performance per animal whether grazing rotationally or continuously. Twenty per cent less land was needed to sustain the rotation grazing system, and legume stands were maintained in a more vigorous condition.

Since a cow will produce the same quantity of milk when pastured under a continuous grazing system that she will when pastured under a rotational grazing system, under what conditions should a rotational grazing system be used? In a farm enterprise where land is scarce and high priced, thereby limiting the size of the operation, rotational grazing can be practiced to good advantage. This type of grazing allows for more complete utilization of the forage grown, and more animals can be fed on fewer acres.

These cows have grazed their fill on high-quality rotation pasture and have stopped momentarily as they make their way to shade and water.

The maintenance of a legume stand is perhaps enough reason for rotational grazing when a pasture is to be grazed over a period of years. It was observed that rotationally-grazed pastures were more productive during prolonged drought than plots continuously grazed. Cows on the rotationally-grazed plots obtained a more uniform diet with a higher protein level than the cows on the plots grazed continuously. The best results from rotational grazing are obtained where the heavier producing cows precede the lower producers and have access to the better forage.

The practice of rotational grazing is not without disadvantages. An obvious disadvantage is the requirement for fencing to divide pastures into smaller units. Managerial ability is also another important item. If cows being rotationally grazed are kept on a unit too long before moving to a fresh unit, production will be lowered. This is especially serious with cows in mid-lactation, since they seldom recover to their previous level of production. Consequently, if animals are left on a plot long enough to utilize all of the forage, and are forced to utilize over-mature forage, the principal advantage of rotational grazing is lost.

GREEN FEEDING SYSTEMS
(Also known as
GREEN CHOP-ZERO GRAZING OR SOILAGE)

In recent years some Ohio dairymen have tested out a relatively new pasture system known as **green feeding.** In this system the feed is chopped daily (once or twice) and fed to the cattle. Green feeding is most successful where land, not labor or machinery, is a limiting factor.

This dairyman makes good use of rye as green feed in April and May. Cows eat directly from racks mounted on the wagon.

Self-unloading wagons provide an easy method of handling green feed. This dairyman was feeding an alfalfa-bromegrass mixture in early June.

For this system to be practical, it is necessary to use tall growing forages such as an alfalfa-grass mixture, sudan grass and oats. In taking a critical look at this pasture system, the following advantages are apparent:

1. Saves forage by the elimination of poor grazing habits.
2. Animals are nearer the buildings and can be kept under close observation at all times.
3. No fencing required.
4. No special provisions need be made for water.
5. Fewer acres per cow required than for most systems.
6. The bloat problem is reduced.
7. Milk production is less likely to fluctuate.
8. It is easier to control weeds through green chopping than grazing.
9. Reduces loss from trampling or soiling of the forage.
10. Cows do not need to walk long distances to obtain forage.

While the system has a number of advantages, it is not without its disadvantages. Some of these are listed as follows:

1. This system usually not advisable for small herds (less than 30 cows).
2. Additional daily labor required; forage must be chopped at least once, and sometimes twice daily.
3. May require additional machinery; tractor and forage harvester must be available every day.
4. Sanitation (fly and odor problems).
5. Wet weather may prohibit harvesting some days; need to have standby pasture or other available forage.
6. Not adapted to low growing or short crops.
7. Cows must eat entire plant; no selection is possible, as with grazing.
8. Difficult to control stage of maturity of the forage to maintain a uniform supply.

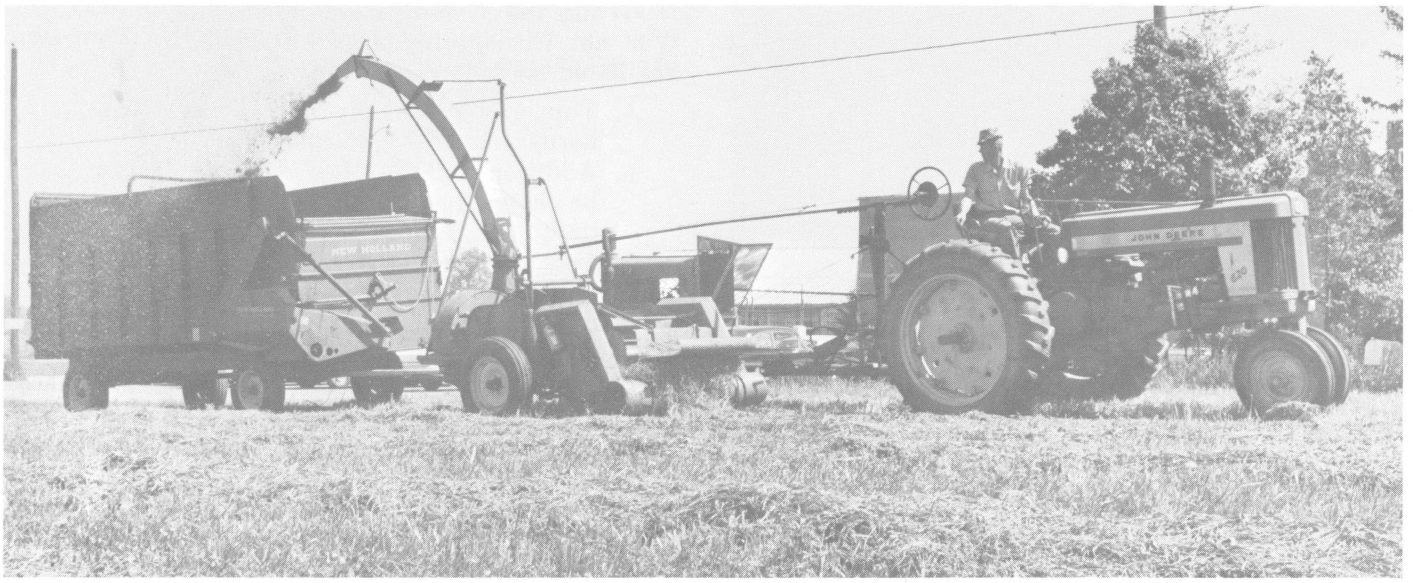
STORED FEEDING

Feeding out of storage is a variation of the green feeding system. The equipment and labor requirements are about the same as for green feeding, but are used more intensively at the beginning of the season. Changing to year-round, stored feeding usually requires additional storage space, in the form of silos and/or mows. With this system the forage can be harvested at optimum cutting dates. Some advantages of stored feeding are:

1. This system requires fewer acres per cow than continuous, rotation, or strip grazing.
2. The forage can all be harvested at or near its best growth stage.
3. When this system is used year-round, it eliminates the need for most fences.
4. Dairymen can achieve better land management by adopting practices of strip farming on the contour, where topography indicates that such practices should be followed.
5. Stored feeding permits the use of storage facilities the year-round.
6. There is no loss from trampling or soiling of the forage.
7. It is easier to maintain legume stands.
8. As in green feeding, animals are located near the buildings where they can be observed closely and the facilities for watering the herd need little attention or alteration.

Some disadvantages to stored feeding are:

1. In most cases, this system does not allow freedom from the winter routine.
2. Sanitation can become a problem as a result of manure, flies, and odor.
3. This system makes it necessary to have a paved feeding area.
4. High labor requirement at time of harvest.



A wilted alfalfa-grass mixture (50 per cent dry matter) is being chopped for high dry matter silage on May 25.

Stored feeding is most useful under intensive conditions; for example, high soil fertility levels, high land prices, limited land area, high producing herds, and high milk prices.

GREEN FEEDING OR ROTATIONAL GRAZING

Many dairy farmers make hay or silage from part of their first crop rotation pasture and graze the rest. Both rotational grazing and green feeding facilitate this practice. More pasture acreage is needed from mid-summer on because of slower forage growth.

While rotation grazing and green feeding permit more intensive use of an existing meadow area, they also add to pasture costs. During 1956 and 1957, Ohio workers obtained cost and other information from dairymen of the state on green feeding and rotational grazing systems. The purpose of this survey was to determine whether returns from using either or both of these systems would be greater than added cost.

Cows maintain good body condition and hold up well in production when good quality feed is available year round.

In this study, workers found that about $\frac{3}{5}$ of an acre per cow was used early in the season for green feeding, and the area was increased to $\frac{4}{5}$ of an acre per cow during the latter part of the pasture season. Farmers using rotational grazing provided $\frac{3}{4}$ acre per cow early, and increased it to more than $1\frac{1}{10}$ acres later. A conventional grazing system requires about $\frac{4}{5}$ of an acre early but $1\frac{3}{4}$ acres must be provided near the end of the pasture season. These workers point out that if a given acreage of forage were green chopped, it would provide forage for 25 per cent more cows than if rotationally grazed, and for about 40 per cent more cows if conventionally grazed. At the O.A.R.D.C., workers have obtained more milk per acre from green feeding than from continuous grazing. Farmers practicing green feeding fed about 50 cows compared to 30 cows for those using rotational grazing. This allowed the higher equipment and labor costs of green chopping to be spread over larger numbers of cows. Regardless of the system, the added production of milk must pay the added cost.

Unless more cows are added, the shift to intensive forage systems will add little to farm income.

In this study, Ohio dairymen using rotational grazing had an additional cost of $3.10 per cow and costs of using green feeding averaged $14.75 per cow more than continuous grazing programs. Additional costs included installation of temporary fencing, labor for moving cattle, clipping for rotational grazing, and the use of equipment such as chopper, tractor, bunks and wagons, and extra labor for green feeding.

The Ohio workers found that the average added labor used per cow for the season ranged from 1.2 to 3.8 hours per cow for rotational grazing, and 3.7 to 5.7 hours per cow for green feeding. On the farms studied, chopping was disrupted an average of 3½ days during the season because of soft fields, breakdowns, and rain. The feed requirements for these days were met with hay, silage, or pasture.

For dairymen who are thinking of changing to green feeding or rotation grazing, the Ohio workers suggest consideration of the following points:

1. Milk production will need to be increased at least 100 pounds per acre with rotational grazing and 350 to 400 pounds per acre with green feeding over that produced with conventional grazing to break even.
2. Yield of forage per acre must be high.
3. Neither system will add much to income unless more cows are added (unless over-stocking has been practiced).
4. If one of these systems is adopted, rotational grazing may be the more profitable of the two on most farms.
5. Both systems enabled farmers in this study to produce more milk on the same acreage.

CARRYING CAPACITY, EFFICIENCY OF HARVESTING, AND MILK PER ACRE UNDER VARIOUS FORAGE FEEDING SYSTEMS

With the increase in herd size that has taken place in recent years, at the same time there has also been an increase in the number of farms using some of the more efficient methods of utilizing summer forage. Table 3 illustrates that the adoption of efficient methods of harvesting could permit herd expansion with no increase in farm size.

Table 3

Approximate Number Acres Required per Cow per 110-120-Day Pasture Season

Kind of Pasture	Method of Grazing	Acres Per Cow Per Season
Woods pasture	Continuous	10-20
Renovated (open fields)	Continuous	3-5
Grass-Legume Mixture	Continuous	2-4
Grass-Legume Mixture	Rotation	1-2
Grass-Legume Mixture	Strip Grazing	¾-1
Grass-Legume Mixture	Green Feeding	½-1
Grass-Legume Mixture	Stored Feeding	½

(H. J. Larsen—Wis. J.D.S., Vol. 42, pp. 575)

For tall growing forages, such as an alfalfa-grass mixture, it is generally found that the greater the control of the grazing program, the greater the efficiency of utilization of standing forage. Table 4 emphasizes this point from work carried out with dairy animals utilizing alfalfa-grass mixtures at a number of Midwest experiment stations.

Regardless of the forage system used, high-producing cows also need an ample supply of clean, fresh water.

Table 4

Efficiency of Harvesting Forage by Dairy Cattle (3-year average)

System	Dry Matter Available Per Acre	D.M. Consumed	D.M. Uneaten	% Loss
Conventional	4250 lbs.	1275-1700 lbs.	2975-3550 lbs.	60-70
Rotational Grazing	5856 lbs.	3318 lbs.	2538 lbs.	43
Strip Grazing	6108 lbs.	4188 lbs.	1920 lbs.	31
Green Feeding	5469 lbs.	5358 lbs.	111 lbs.	2
Stored Feeding	7099 lbs.	6326 lbs.	773 lbs.	11

As previously mentioned, under a well managed system of forage feeding, there is little if any change in milk production on a per cow basis, provided sufficient high quality forage is available at all times. Table 5 shows considerable difference, however, on a per acre basis. Data in Table 5 have been obtained over three consecutive years from an experiment now in progress at two stations in Wisconsin.

Table 5

Milk Production (4% F.C.M.) under Various Systems of Summer Feeding (3-year average)

System	Milk Per Cow Per Milking Day	Lbs. Milk Per Acre*	Milk Per Acre Increase Over Rotation	Level of Concentrate Feeding Per Day
Rotation	34.3	2411	....	4.5
Strip Grazing	37.1	4292	1881	5.2
Green Feeding	37.9	5190	2779	4.9
Stored Feeding	36.3	6056	3645	8.3

* Per cent of TDN received from forage × total F.C.M. (H. J. Larsen Wisconsin J.D.S., Vol. 42, p. 576)

Most studies which have been reported show increased milk per acre for rotational over continuous grazing, for strip grazing over rotation, and

for green feeding over strip grazing. Production per cow does not necessarily follow the same pattern, because the cow is more selective in what she grazes than she can be when the crop is mechanically cut and brought to her. On the basis of a four-year study of alternative pasture systems on Michigan dairy farms, and the published and unpublished data from experiments in other states, the estimated increases in livestock carrying capacity during the pasture season when three alternative pasture systems are adopted are listed in Table 6.

Table 6

Change from improved grazing to [1]	Estimated increase in carrying capacity (%)
Strip Grazing	15 20
Green Chopping	25 35[2]
Storage Feeding	20 35

Improved grazing contrasted to straight continuous grazing is described as including some form of rotational grazing and the supplementary feeding of hay and/or silage when pasture supply becomes short

Depends on kind and quality of forage chopped and weather

[1]Depends on storage losses It is estimated that carrying capacity will be increased by 30 per cent for upright silos and 25 per cent for bunker silos, when improved and suitable practices are used

(C R Hoglund—Michigan State University Ag Econ No 695)

USE OF PASTURE IN OHIO DHIA HERDS

The 1965-66 summary of 2093 DHIA herds with complete feed records shows that 357 herds were reported with 0 pasture days. Table 7 lists the averages for milk production, feed fed, value of product, feed cost, income over feed cost, and cost per cwt. of milk based upon the per cent of net energy obtained from pasture (grazing).

These data show that the average production per cow was slightly higher in those herds using stored feeding almost exclusively but that total feed cost and feed cost per cwt. of milk produced was also slightly higher. These data suggest that those herds receiving a high proportion of net energy from pasture could afford to either improve the pasture or make use of more supplemental feeding to increase production and, thereby, further increase the value of product and income over feed cost. Herds that rely almost totally on stored feeding, even though feed costs and feed cost per cwt. of milk produced are higher, have the opportunity of handling more cows on the same acreage.

YEAR-ROUND FEEDING OR DRY LOT FEEDING

Dry lot dairying means feeding dairy cattle in confinement or semi-confinement all year. This system of feeding dairy cattle varies all the way from the highly specialized operations in California, where all feeds and replacements are purchased, to those operations which not only produce milk but also raise all or most of the feed and replacements.

Many Ohio farmers who have made substantial increases in herd size have tended to buy more concentrate feeds but have continued to grow most of their forage. A few dairymen have purchased substantial quantities of hay. If herd size continues to increase and land becomes more expensive, it is possible that many Ohio dairymen will buy large quantities of both grain and hay as they expand the number of cows milked. The big question is, whether it will be profitable for Ohio dairymen to purchase most or all of their feed and herd replacements.

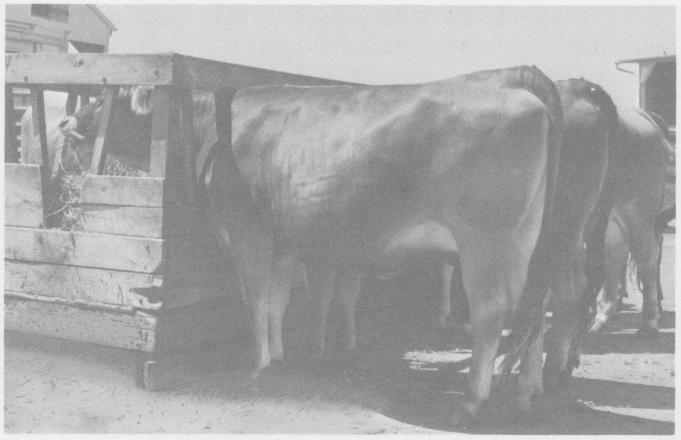
There are many factors which have contributed to the unique and varied dairying found in the various regions of California. Physical isolation from other milk sources is an important factor in the development of the large scale dairy farms in the Los Angeles area. The ocean, deserts, and mountains are effective barriers in keeping milk out of the market areas. The availability of high quality hay in unlimited quantities makes possible milk factory type operations in several areas of California. Other factors contributing to the development of dry-lot dairying in California include:

1. Opportunity of concentration of all efforts and skills in the production of milk.
2. Possibility of gearing herd size to labor and barn capacity rather than to the quantity of feed produced.
3. Availability of capital to finance large scale dairy operations.
4. Better control over seasonal pattern of production in line with demand.

Near Ohio's metropolitan centers land is becoming increasingly scarce and high priced. In view of this, dairymen in these areas may well follow the trend of those in California in the development of

Table 7

Per Cent Net Energy Pasture	Herd Size Cow Years	Production (lbs)	Grain (lbs)	Silage (lbs.)	Hay (lbs)	Value Product ($)	Feed Cost ($)	Income Over Feed Cost ($)	Cost/Cwt Milk ($)
0	48	12,707	4600	17,300	3700	552	253	299	2 02
3	44	12,698	4700	15,900	4100	554	258	296	2 06
10	42	12,374	4600	12,100	4360	546	248	298	2 03
19	36	11,838	4400	6,600	4200	526	228	298	1 96
28	32	11,520	4000	4 500	3700	510	212	298	1 87



Feeding bred heiters and cows top-quality hay in V-racks, when they are cared for in dry lots or on pasture in summer, is another way to hold body condition and boost production.

highly specialized factory-type operations. On the other hand, many dairymen in the next few years may simply relocate in the more rural areas and continue dairying in a less specialized manner.

As the size of herds becomes larger, the problems of handling manure and liquid waste become more important. These problems become extremely important in dry lot dairy farming where fields may not be available on which to spread manure or liquids. Under any system, however, dairymen are faced with the problem of continual removal of manure, in order to qualify for Grade A milk production.

To achieve success in dry-lot dairying, a dairyman must possess the following qualities (Quarterly Bulletin Vol. 44, No. 1, Michigan State University, August, 1961) :

1. Ability to organize, finance, and operate large scale businesses.
2. Ability to bargain. Must be skilled in knowing how much to pay for feed and replacements in relationship to their relative values.
3. Ability to attain a high level of internal efficiency.

SUGGESTIONS FOR PLANNING FORAGE NEEDS

An abundant year-round supply of quality forage is a basic ingredient of nearly every successful dairy operation in Ohio. To achieve this objective, dairymen must do careful planning and hard work, but the results seem worth the effort.

The following tables are offered as an aid in planning for forage needs of a dairy herd. Table 8 lists forages and their relative suitability for use under five different forage systems.

Zero indicates that the forage is not recommended for the system and, on the other end of the scale, a rating of 3 implies that this forage is of greatest value in that system. To further illustrate, bluegrass is best suited for continuous grazing (rating of 3), whereas it is not recommended at all (rating of 0) for green chopping or stored feeding.

Table 8

Relative Suitability of Forages for Various Systems[1]

Forages	Continuous Grazing	Rotation Grazing	Strip Grazing	Green Chopping	Stored Feeding Silage or Haylage
Bluegrass	3	2	1	0	0
Sudan grass	1	3	2	3	2
Sorghum-Sudan crosses	0	2	1	3	2
Tall Grass (orchard, brome, timothy)	1	2	2	2	3
Alfalfa-Grass Mixtures	0	2	2	3	3
Forage Sorghums	0	0	0	1	3
Corn	0	0	0	2	3
Small Grains (oats, wheat, barley)	0	0	0	2	3
Rye	0	2	3	2	1

[1] Suitability Rating

0—Not recommended
1—Of limited value
2—Of considerable value
3—Of greatest value

Table 9 illustrates the months of greatest yield for various kinds of forages. Alfalfa-grass mixtures are at their best in May and June; whereas corn, for example, has its greatest value in September.

Table 9

Approximate Periods Greatest Utilization[1] During Growing Season

Forage	April	May	June	July	August	September	October
Bluegrass	1	3	2	0	0	1	1
Sudan grass	0	0	1	2	3	2	1
Sorghum-Sudan Crosses	0	0	1	2	3	2	1
Tall Grasses (orchard, brome, timothy, etc.)	1	3	2	2	1	2	2
Alfalfa-Grass Mixtures	1	3	3	2	2	1	0
Forage Sorghums	0	0	0	0	1	2	3
Corn	0	0	0	0	1	3	2
Small Grains, (wheat, oats, barley)	1	3	2	0	0	0	0
Rye	2	3	0	0	0	0	0

[1] Utilization Rating by Month

0—Poor
1—Fair
2—Good
3—Best

To insure an adequate supply of forage year round, it is recommended that dairymen plan for enough forage to supply 3 pounds of good hay equivalent per 100 pounds of animal per day. Assuming that all forage was to be provided by hay and/or silage, Table 10 gives the estimated needs for cows on a daily basis, for a 240-day feeding period, and for year-round feeding.

Table 10

Hay and Silage Requirements per Cow

Weight of Cows (lbs.)	Pounds Hay Equivalent Per Day (lbs.)	Tons of Hay Equivalent (240 day feeding period) (tons)	Tons of Hay Equivalent (365 days) (tons)
800	24	2.9	4.2
1000	30	3.6	5.5
1200	36	4.3	6.6
1400	42	5.0	7.7
1600	48	5.8	8.8

If silage is part or all of the roughage ration, substitute for each pound of hay:

3 pounds wilted grass silage—
60% moisture

2 pounds high dry matter silage—
45% moisture

2½ to 3 pounds corn silage—
60%-65% moisture

Table 11 contains a number of factors to consider when planning a forage system.

Table 11

Factors to Consider in Choosing a Forage System

Consideration	Continuous Grazing	Rotational and Strip Grazing	Green Feeding (Zero-Grazing or Soilage)	Storage Feeding
1. Managerial skill	Low	High	High	Medium
2. Labor requirements	Low	Medium	High	High early Medium otherwise
3. Size of herd	Not important	Not important	Costly for small	Costly for small
4. Acres of land	Extensive	Limited in relation to cow numbers	More limited in relation to cow numbers	Still more limited in relation to cow numbers
5. Location of summer forage	Available to water shade and buildings	Need easy access to water, shade and buildings	Forage across busy highway or distant from water and building	Forage across busy highway or distant from water and buildings
6. Manure	Directly on land	Directly on land may need to scatter	A problem. Hard surface feeding area needed	A problem. Hard surface feeding area needed
7. Power and equipment	No special	No special	Tractor and chopper available daily	Tractor and chopper in early season
8. Special forage equipment	Hay rack or feed bunks	Electric fencing	Direct chop forage head, self-feeding wagon	Automatic self-feeding silage equipment
9. Possibility of supplying high quality forage for all season	High, early; low, otherwise	High, early; good management prolongs grazing	Very good—grow 2 to 3 forage crops of different maturity	Very good
10. Productive stands	Important	Very important	Even more important	Important